

What is claimed is:

1. An image editing apparatus which edits image data which has been coded in accordance with an image coding method, wherein a plurality of image frames constituting the image data are divided into groups, each image frame is coded into one of a first type image frame which is created by coding data in the image frame, a second 5 type image frame which is created by performing inter-frame mono-directional prediction based on a past image frame and coding a difference obtained by the prediction, and a third type image frame which is created by performing inter-frame dual-directional prediction based on a past image frame and a future image frame and coding differences obtained by the prediction, and the plurality of image frames are coded so that a head 10 frame of each group may be the first type image frame, said apparatus comprising:
 - an image coder which codes each of frames of image data into one of the first type image frame, the second type image frame, and the third type image frame;
 - an image decoder which decodes the image frame coded by said image coder; and
 - an image data analyzer which determines types of image frames included in each 15 group,
 - wherein: said image data analyzer determines whether or not a head group which is arranged at a head of an editing target area included in the image data is a closed group which does not include the third type image frame which is to be decoded by referring to an image frame included in a group which is arranged before the head group; and
 - 20 in a case where said image data analyzer determines that the head group is not the closed group, said image coder converts a portion near the head of the editing target area into the closed group.
2. The image editing apparatus according to claim 1, wherein said image data analyzer determines whether or not the third type image frame included in the head group is an image frame which is to be decoded by referring to an image frame included in a group which is arranged before the head group.

3. The image editing apparatus according to claim 2, wherein:

in a case where said image data analyzer determines that the third type image frame is to be decoded by referring to an image frame included in the group arranged before the head group, the image decoder decodes the third type image frame; and

5 said image coder codes the third type image frame which is determined by said image data analyzer as an image frame to be decoded by referring to an image frame included in the group arranged before the head group, and is decoded by said image decoder, into an image frame which is able to be decoded without referring to an image frame included in the group arranged before the head group.

4. The image editing apparatus according to claim 1, wherein:

said image coding method is an MPEG method;

each of the groups is a GOP of MPEG;

the first type image frame is an I picture;

5 the second type image frame is a P picture; and
the third type image frame is a B picture.

5: An image editing apparatus which edits image data which has been coded in accordance with an MPEG method, said apparatus comprising:

image data analyzing means for analyzing a structure of image frames included in each GOP of the image data, and determining an attribute of each GOP and picture types

5 of image frames included in each GOP;

conversion point detecting means for detecting a GOP which needs to be re-coded from an editing target area of the image data, and an image frame which needs to be re-coded from the detected GOP;

image decoding means for decoding the image frame which needs to be re-coded
10 detected by said conversion point detecting means;

GOP converting means for creating a new GOP by re-coding the image frame
decoded by said image expanding means; and

image data concatenating means for concatenating a plurality of image data which are cut out as editing target areas,

15 wherein: said image data analyzing means determines whether or not a head GOP which is arranged at a head of the editing target area is a closed GOP; and

in a case where said image data analyzing means determines that the head GOP of the editing target area is not a closed GOP, said GOP converting means converts a portion near the head of the editing target area into a closed GOP.

6. An image editing apparatus which edits image data which has been coded in accordance with an image coding method, wherein a plurality of image frames constituting the image data are divided into groups, each image frame is coded into one of a first type image frame which is created by coding based on data in the image frame, a 5 second type image frame which is created by performing inter-frame mono-directional prediction based on a past image frame, and a third type image frame which is created by performing inter-frame dual-directional prediction based on a past image frame and a future image frame, and the image data is coded so that a head frame of each group may be the first type image frame, said apparatus comprising: an image encoder which 10 codes each of frames of image data into one of the first type image frame, the second type image frame, and the third type image frame in accordance with said image coding method;

an image decoder which decodes the image frame coded by said image encoder; and an image data analyzer which determines types of image frames included in each

15 group,

wherein: in a case where said image data analyzer determines that a head image frame which is arranged at a head of an editing target area included in the image data is not the first type image frame, said image decoder decodes the head image frame, and each image frame appearing between the head image frame and the first type image frame 20 which appears first after the head image frame; and

said image encoder re-codes the image frames which are created by decoding the head image frame and each image frame appearing between the head image frame and the first type image frame which appears first after the head image frame, and re-codes the head image frame into the first type image frame, and re-codes any of the third type
25 image frame appearing after the head image frame into an image frame which is able to be decoded without referring to an image frame arranged before the head image frame.

7. The image editing apparatus according to claim 6, wherein:

in a case where said image data analyzer determines that the head image frame of the editing target area is not the first type image frame, the image decoder decodes any of the third type image frame that appears after the first type image frame which appears
5 first after the head image frame if any of the third type image frame is an image frame which is to be decoded by referring to an image frame which is arranged before the first type image frame; and

said image encoder re-codes the image frame which is created by decoding any of the third type image frame that appears after the first type image frame which appears
10 first after the head image frame.

8. The image editing apparatus according to claim 6,

wherein when said image encoder re-codes the image frames which are created by decoding each frame appearing between the head image frame and the first type image frame which appears first after the head image frame, said image encoder re-codes any of
5 the third type image frame that appears after the head image frame into the third type image frame that is able to be decoded without referring to an image frame which is arranged before the head image frame.

9. The image editing apparatus according to claim 6, wherein:

in a case where said image data analyzer determines that the head image frame of the editing target area is the first type image frame, said image decoder decodes any of the third type image frame that appears after the head image frame; and

5 said image encoder re-codes the image frame which is created by decoding any of the third type image frame that appears after the head image frame into an image frame which is able to be decoded without referring to an image frame which is arranged before the head image frame.

10. The image editing apparatus according to claim 6, wherein:

in a case where said image data analyzer determines that the head image frame of the editing target area is the first type image frame, said image decoder decodes any of the third type image frame that appears after the head image frame; and

5 said image encoder re-codes the image frame which is created by decoding any of the third type image frame that appears after the head image frame into the first type image frame.

11. The image editing apparatus according to claim 6, wherein:

in a case where said image data analyzer determines that the head image frame of the editing target area is the first type image frame, said image decoder decodes any of the third type image frame that appears after the head image frame; and

5 said image encoder re-codes the image frame which is created by decoding any of the third type image frame that appears after the head image frame into the third type image frame which is able to be decoded without referring to an image frame which is arranged before the head image frame.

12. The image editing apparatus according to claim 6, wherein

said image coding method is an MPEG method;

each of the groups is a GOP of MPEG;

the first type image frame is an I picture;

5 the second type image frame is a P picture; and

the third type image frame is a B picture.

13. An image editing apparatus which edits image data which has been coded in accordance with an image coding method, wherein a plurality of image frames

constituting the image data are divided into groups, each image frame is coded into one of a first type image frame which is created by coding based on data in the image frame, a 5 second type image frame which is created by performing inter-frame mono-directional prediction based on a past image frame, and a third type image frame which is created by performing inter-frame dual-directional prediction based on a past image frame and a future image frame, and the image data is coded so that a head frame of each group may be the first type image frame, said apparatus comprising:

- 10 an image encoder which codes each of frames of image data into one of the first type image frame, the second type image frame, and the third type image frame in accordance with said image coding method;
- an image decoder which decodes the image frame coded by said image encoder; and
- an image data analyzer which determines types of image frames included in each

15 group,

wherein: said image data analyzer determines whether a first condition that the first type image frame which appears first in an editing target area included in the image data coded in accordance with said image coding method is a head image frame which is arranged at a head of a group, and a second condition that the group is a closed group

- 20 which does not include the third type image frame which is to be decoded by referring to an image frame included in a group which is arranged before the group are satisfied or not;

in accordance with a result of determining the first condition and the second condition, said image decoder decodes any of the third type image frame that appears 25 after the first type image frame appearing first in the editing target area and that needs to be re-coded; and

said image encoder re-codes the image frame which is created by decoding any of the third type image frame that appears after the first type image frame which appears first in the editing target area.

14. The image editing apparatus according to claim 13, wherein:

in a case where said image data analyzer determines that one of the first condition and the second condition is not satisfied, said image decoder decodes any of the third type image frame that appears after the first type image frame which appears first in the editing target area; and

said image encoder re-codes the image data which is created by decoding any of the third type image frame that appears after the first type image frame which appears first in the editing target area.

15. The image editing apparatus according to claim 13, wherein:

in a case where said image data analyzer determines that the first condition is satisfied and the second condition is not satisfied, said image encoder re-codes the image frame which is created by decoding any of the third type image frame that appears after the first type image frame which appears first in the editing target area into the first type image frame.

16. The image editing apparatus according to claim 13,

wherein in a case where said image data analyzer determines that the first condition is satisfied and the second condition is not satisfied, said image encoder re-codes the image frame which is created by decoding any of the third type image frame that appears after the first type image frame which appears first in the editing target area into the third type image frame which is able to be decoded without referring to an image frame which is arranged before the head image frame.

17. The image editing apparatus according to claim 13,

wherein in a case where said image data analyzer determines that the first condition and the second condition are satisfied, said image editing apparatus copies the image frame which is created by decoding any of the third type image frame that appears after the first type image frame which appears first in the editing target area to the image data after being edited.

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18. The image editing apparatus according to claim 13, wherein
said image coding method is an MPEG method;
each of the groups is a GOP of MPEG;
the first type image frame is an I picture;
5 the second type image frame is a P picture; and
the third type image frame is a B picture.
19. An image editing method for editing image data which has been coded in
accordance with an image coding method, wherein a plurality of image frames
constituting the image data are divided into groups, each image frame is coded into one of
a first type image frame which is created by coding based on data in the image frame, a
5 second type image frame which is created by performing inter-frame mono-directional
prediction based on a past image frame, and a third type image frame which is created by
performing inter-frame dual-directional prediction based on a past image frame and a
future image frame, and the plurality of image frames are coded so that a head frame of
each group may be the first type image frame, said image editing method comprising:
10 setting an editing target area in the image data which has been coded in accordance
with said image coding method;
determining whether a head group which is arranged at a head of the editing target
area is a closed group which does not include the third type image frame which is to be
decoded by referring to an image frame included in a group which is arranged before the
15 head group; and
converting a portion near the head of the editing target area into the closed group in
a case where said determining determines that the head group is not the closed group.
20. The image editing method according to claim 19, further comprising:
determining whether any of the third type image frame included in the head group of
the editing target area is an image frame which is to be decoded by referring to an image
frame included in a group which is arranged before the head group;

5 decoding any of the third type image frame determined as an image frame which is
to be decoded by referring to an image frame included in a group which is arranged
before the head group; and

coding any of the decoded third type image frame into an image frame which is able
to be decoded without referring to an image frame included in a group which is arranged
10 before the head group.

21. The image editing method according to claim 19, wherein
said image coding method is an MPEG method;
each of the groups is a GOP of MPEG;
the first type image frame is an I picture;
5 the second type image frame is a P picture; and
the third type image frame is a B picture.

22. An image editing method for editing image data which has been coded in
accordance with an MPEG method, said image editing method comprising:
setting one or more editing target areas in the coded image data;
determining whether a head GOP which is arranged at a head of each of the one or
5 more editing target areas is a closed GOP;

determining a picture type of a head image frame which is arranged at the head of
each editing target area;
detecting a GOP which needs to be re-coded, and an image frame which is included
in the GOP and needs to be re-coded in accordance with a result of said determining
10 whether a head GOP of each editing target area is a closed GOP, and a result of said
determining a picture type of a head image frame of each editing target area; and
re-coding the detected image frame which needs to be re-coded, after it is decoded.

23. The image editing method according to claim 22, further comprising:
determining a picture type of a next image frame which is arranged next to the head
image frame of each editing target area, in a case where said determining whether a head

GOP is a closed GOP determines that the head GOP of each editing target area is not a
5 closed GOP;

decoding the next image frame and following image frames which are B pictures, in
a case where said determining a picture type of a next image frame determines that the
next image frame is a B picture, after decoding an image frame which is an I picture
which is encountered first when going back in a reverse direction from the head image
10 frame, each image frame between the encountered image frame and the head image frame,
and the head image frame;

re-coding each decoded image frame, and re-coding the image frames which are
created by decoding the following image frames which are B pictures into image frames
which are able to be decoded without referring to an image frame which is arranged
15 before the head image frame; and

recording each of the image frames which are created by re-coding the head image
frame and the following image frames which are B pictures after those image frame are
decoded.

24. The image editing method according to claim 22, further comprising:
decoding the head image frame of each editing target area in a case where said
determining a picture type of a head image frame determines that the head image frame is
a P picture, and also decoding each image frame appearing after the head image frame
5 and before an image frame which is an I picture which appears first after the head image
frame; and

re-coding the image frames which are created by decoding the head image frame
and each image frame appearing after the head image frame, and re-coding the image
frame which is created by decoding the head image frame into an image frame which is
10 an I picture.

25. The image editing method according to claim 22, further comprising:
expanding the image frame which needs to be re-coded by decoding:

creating a new GOP by re-coding the image frame which is decoded by said expanding; and

- 5 concatenating the one or more editing target areas.

26. An image editing method for editing image data which has been coded in accordance with an image coding method, wherein a plurality of image frames constituting the image data are divided into groups, each image frame is coded into one of a first type image frame which is created by coding based on data in the image frame, a 5 second type image frame which is created by performing inter-frame mono-directional prediction based on a past image frame, and a third type image frame which is created by performing inter-frame dual-directional prediction based on a past image frame and a future image frame, and the image data is coded so that a head frame of each group may be the first type image frame, said image editing method comprising:

- 10 setting an editing target area in the image data which has been coded in accordance with said image coding method;

determining a type of a head image frame which is arranged at a head of the editing target area;

- decoding the head image frame of the editing target area and each image frame 15 appearing between the head image frame and the first type image frame which appears first after the head image frame, in a case where said determining a type determines that the head image frame is not the first type image frame; and

re-coding the image frames created by decoding the head image frame and each image frame appearing between the head image frame and the first type image frame 20 which appears first after the head image frame, and re-coding the head image frame into the first type image frame, and re-coding any of the third type image frame that appears after the head image frame into an image frame which is able to be decoded without referring to an image frame which is arranged before the head image frame.

27. The image editing method according to claim 26, further comprising:

- decoding any of the third type image frame that appears after the first type image frame which appears first after the head image frame if any of the third type image frame is an image frame which is to be decoded by referring to an image frame which is 5 arranged before the first type image frame, in a case where said determining a type determines that the head image frame of the editing target area is not the first type image frame; and
- re-coding the image frame which is created by decoding any of the third type image frame that appears after the first type image frame which appears first after the head 10 image frame.
28. The image editing method according to claim 26, further comprising re-coding the image frames created by decoding the head image frame and each image frame appearing between the head image frame and the first type image frame which appears first after the head image frame, and re-coding any of the third type image 5 frame that appears after the head image frame into the third type image frame which is able to be decoded without referring to an image frame which is arranged before the head image frame.
29. The image editing method according to claim 26, further comprising: decoding any of the third type image frame that appears after the head image frame of the editing target area in a case where said determining a type determines that the head image frame is the first type image frame; and
- 5 re-coding the image frame which is created by decoding any of the third type image frame that appears after the head image frame into an image frame which is able to be decoded without referring to an image frame which is arranged before the head image frame.
30. The image editing method according to claim 26, further comprising: decoding any of the third type image frame that appears after the head image frame of the editing target area in a case where said determining a type determines that the head

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image frame is the first type image frame; and

- 5 re-coding the image frame which is created by decoding any of the third type image frame that appears after the head image frame into the first type image frame.

31. The image editing method according to claim 26, further comprising:

decoding any of the third type image frame that appears after the head image frame of the editing target area in a case where said determining a type determines that the head image frame is the first type image frame; and

- 5 re-coding the image frame which is created by decoding any of the third type image frame that appears after the head image frame into the third type image frame which is able to be decoded without referring to an image frame which is arranged before the head image frame.

32. The image editing method according to claim 26, wherein:

said image coding method is an MPEG method;

each of the groups is a GOP of MPEG;

the first type image frame is an I picture;

- 5 the second type image frame is a P picture; and
the third type image frame is a B picture.

33. An image editing method for editing image data which has been coded in accordance with an image coding method, wherein a plurality of image frames constituting the image data are divided into groups, each image frame is coded into one of a first type image frame which is created by coding based on data in the image frame, a second type image frame which is created by performing inter-frame mono-directional prediction based on a past image frame, and a third type image frame which is created by performing inter-frame dual-directional prediction based on a past image frame and a future image frame, and the image data is coded so that a head frame of each group may be the first type image frame, said image editing method comprising:
- 5 setting an editing target area in the image data which has been coded in accordance

with said image coding method;

determining whether a first condition that the first type image frame which appears first in the editing target area is a head image frame which is arranged at a head of a group and a second condition that the group is a closed group which does not include the third

15 type image frame which is to be decoded by referring to an image frame included in a group which is arranged before the group are satisfied or not;

decoding any of the third type image frame that appears after the first type image frame which appears first in the editing target area and that needs to be re-coded, in accordance with a result of determining the first condition and the second condition; and

20 re-coding the image frame which is created by decoding any of the third type image frame that appears after the first type image frame which appears first in the editing target area.

34. The image editing method according to claim 33, further comprising:

decoding any of the third type image frame that appears after the first type image frame which appears first in the editing target area, in a case where said determining determines that one of the first condition and the second condition is not satisfied; and

5 re-coding the image frame which is created by decoding any of the third type image frame that appears after the first type image frame which appears first in the editing target area.

35. The image editing method according to claim 33, further comprising

re-coding the image frame which is created by decoding any of the third type image frame that appears after the first type image frame which appears first in the editing target area into the first type image frame, in a case where said determining determines that the

5 first condition is satisfied, and the second condition is not satisfied.

36. The image editing method according to claim 33, further comprising

re-coding the image frame which is created by decoding any of the third type image frame that appears after the first type image frame which appears first in the editing target

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area into the third type image frame which is able to be decoded without referring to an image frame which is arranged before the head image frame, in a case where said determining determines that the first condition is satisfied, and the second condition is not satisfied.

37. The image editing method according to claim 33, further comprising copying the image frame which is created by decoding any of the third type image frame that appears after the first type image frame which appears first in the editing target area to the image data after being edited, in a case where said determining determines that 5 the first condition and the second condition are satisfied.

38. The image editing method according to claim 33, further comprising inserting a first or second type image frame which appears immediately before a head image frame which is arranged at the head of the editing target area into the head of the editing target area, in a case where the head image frame is the third type image 5 frame.

39. The image editing method according to claim 33, wherein:
said image coding method is an MPEG method;
each of the groups is a GOP of MPEG;
the first type image frame is an I picture;
5 the second type image frame is a P picture; and
the third type image frame is a B picture.